Do we have the courage to develop tomorrow's engineers by engaged education?

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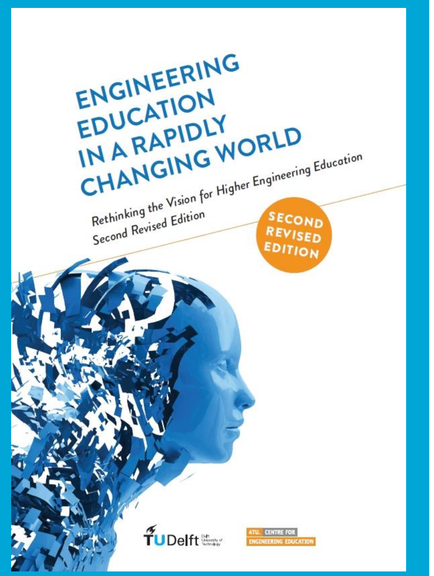
Education in the 21st century

Emphasis remaining on	Shifting to more
Monodisciplinary expert thinking	Multi- and interdisciplinary systems thinking
Reductionism	Integration
Analysis	Synthesis
Abstract learning	Experiential learning; common sense
Developing order	Correlating chaos and resilience
Techno-scientific base	Human factor and empathy; business acumen
Convergent thinking	Creativity
Understanding certainty	Handling ambiguity and failure
Rational problem solving	Complex problem solving
Independence	Collaboration
Rounded expert	Employability and lifelong learning



Source: Kamp A; Engineering Education in a Rapidly Changing World, 2nd rev. ed. Delft, 2016

Technical depth: more important than ever

- Deep working knowledge of engineering sciences is key in
  - Understanding the value and assessing the reliability and usability of the exponentially growing amount of information in our world
  - Systems thinking: connecting the dots

- Creative solutions for engineering problems cannot emerge from a vacuum. They need a broad and ready availability amount of engineering domain knowledge.

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Engaged education

How about the engineering body of knowledge?

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- Challenge students in a way that is inspired by being a member of a “DreamTeam”
- Collaborate in project teams, focused on applying scientific and engineering knowledge and developing collaboration competences and skills to solve purposeful real-world (engineering) challenges

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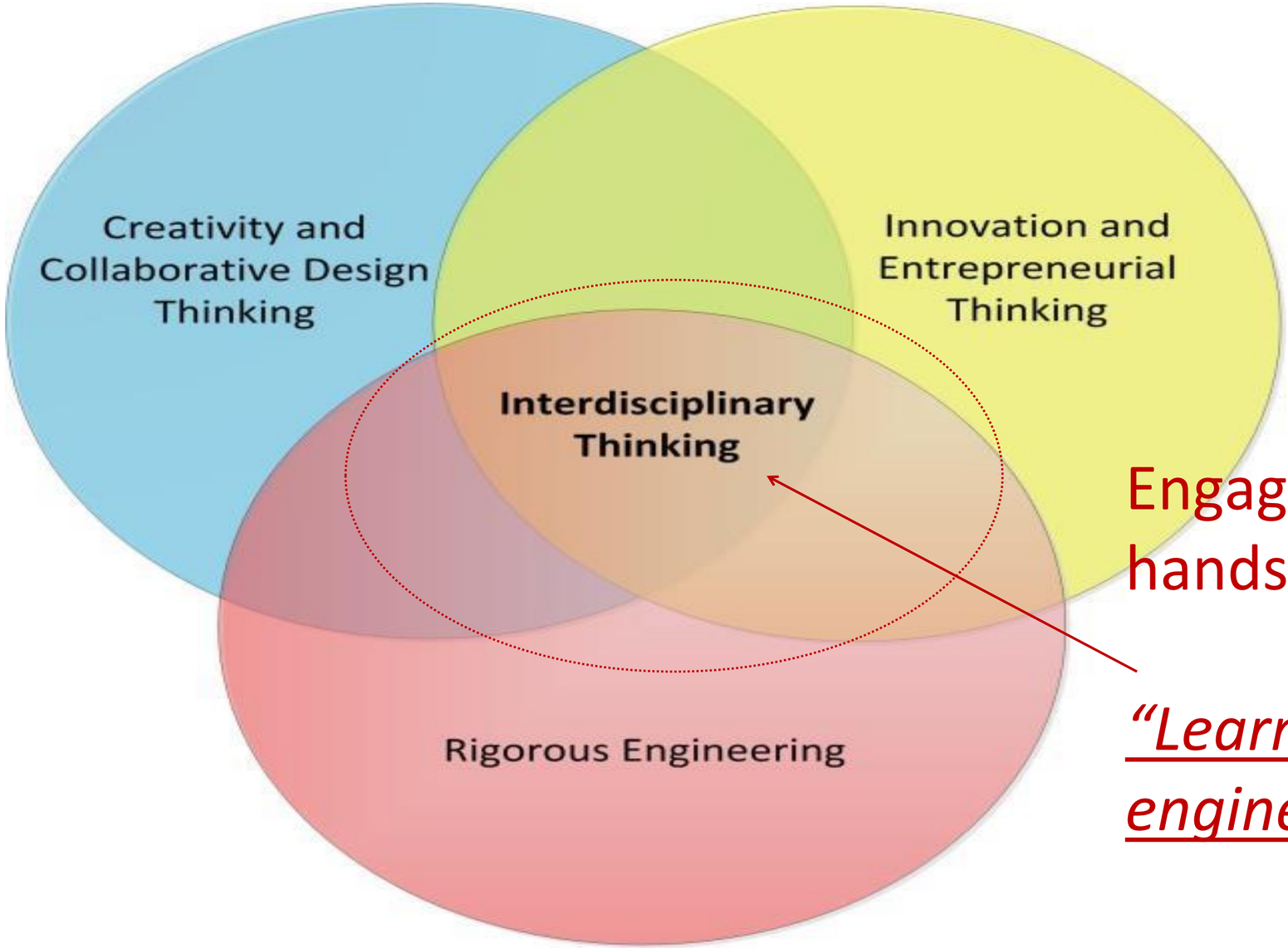
21st Century engineering curricula



Engaged Education
hands-on learning

"Learn how to engineer"

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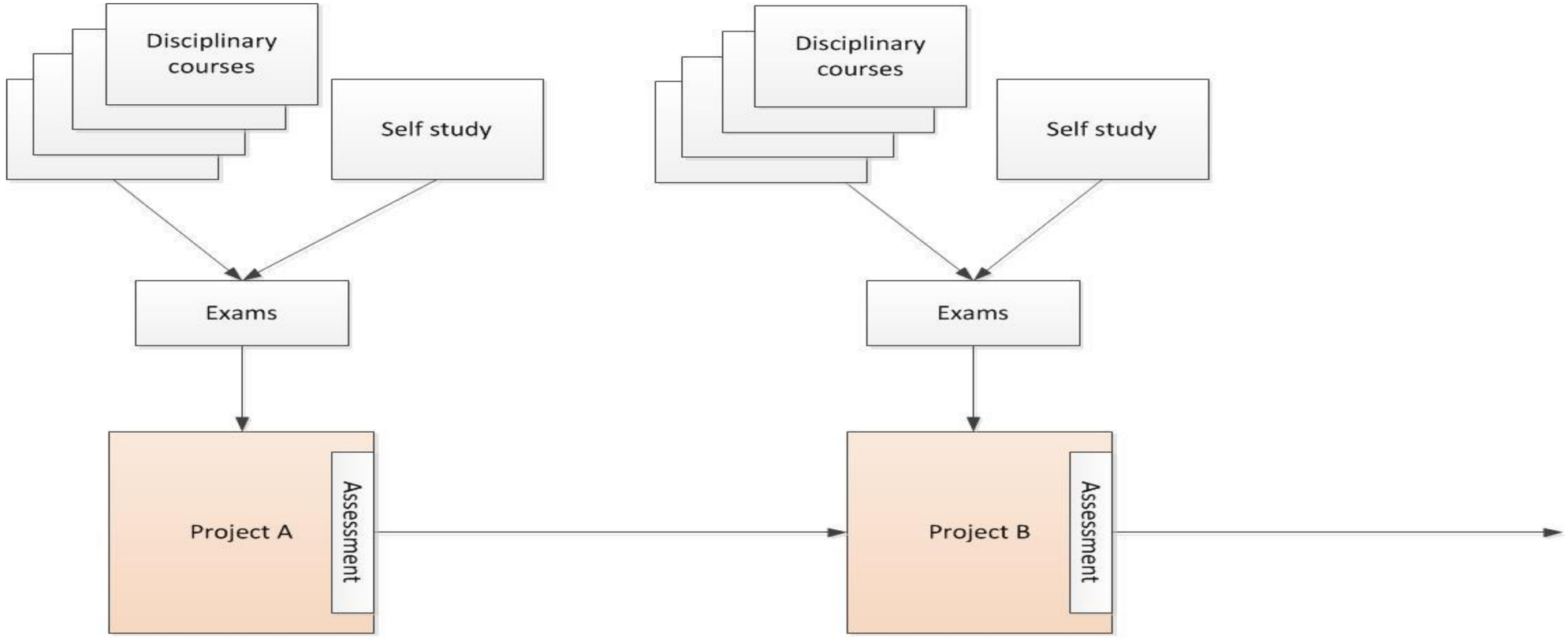
“Traditional” curricular structure



- Intended Learning Outcomes per course and project.
- Exams are about knowledge (memorisation, understanding, application)
- Projects are often supplemental, within discipline or as stand-alone capstone

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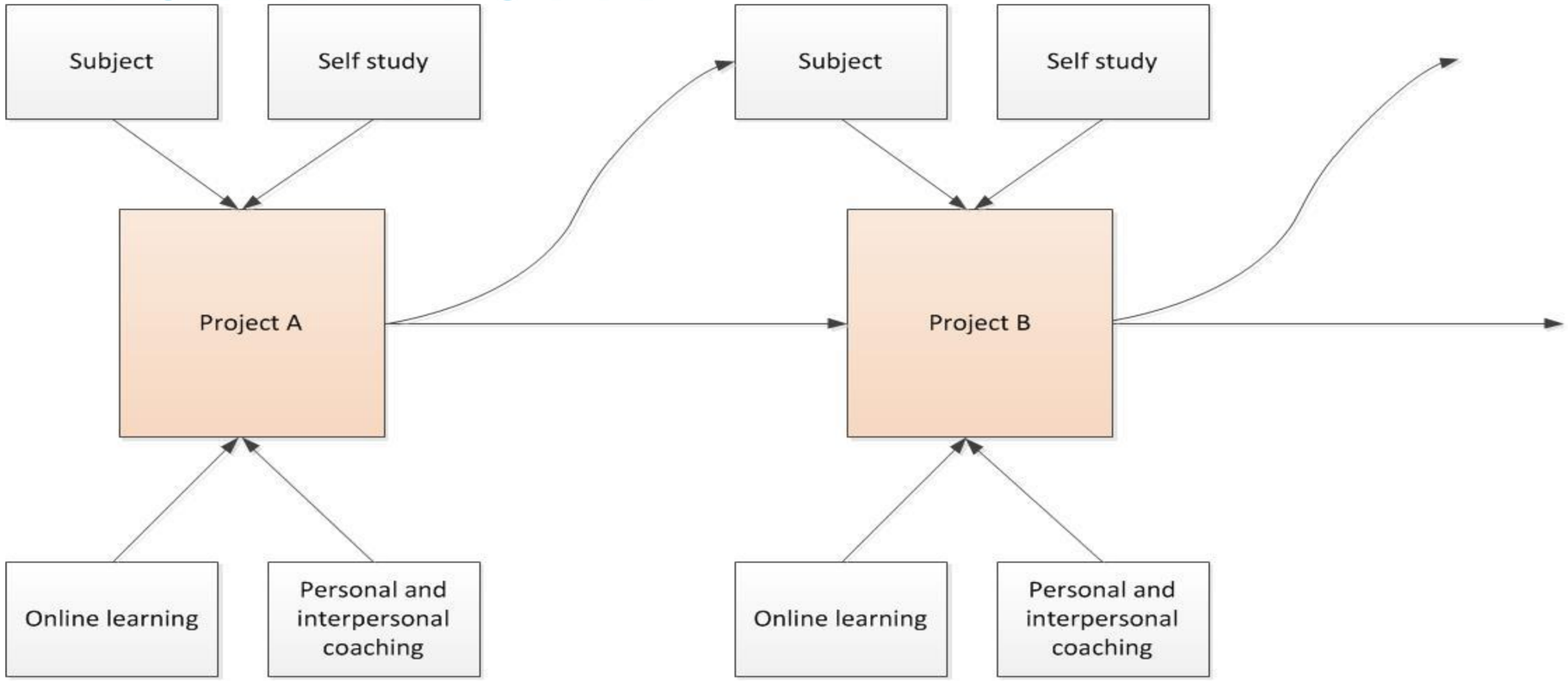
Project-centric curricular framework



- The thread of the projects are the main organiser.
- Learn what you need to know to design a solution.
- Intended Learning Outcomes per project.
- Integral assessment for learning in the projects.

Source: New Engineering Education Transformation (NEET) at MIT School of Engineering

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Key questions Engaged Education

- WHAT EXACTLY DO WE WANT THE STUDENTS TO LEARN IN AN ENGAGED LEARNING ENVIRONMENT?

  Do we have the courage to formulate the Intended Learning Objectives “vague” enough?

- DO WE KNOW WHAT WE HAVE TO DO, SO THAT STUDENTS CAN INTEGRATE LEARNING ACROSS MULTIPLE EXPERIENCES?

- HOW CAN WE MEASURE THE FORMAL DISCIPLINARY KNOWLEDGE AND COMPETENCY LEVELS THAT REALLY MATTER?

  Do we have the courage to avoid assigning grades after all?

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Concerns

- Consolidated Engineering Body of Knowledge
- Academic level
  - Knowledgeable about application of maths and sciences
  - Thoroughly knowledgeable in an engineering domain and conversant in related (technical) fields
- Assessment of ILO’s about theoretical concepts
- Matching ILO’s with learning activities
- Lack of staff expertise to integrate learning activities
- Reluctance to reduce and embed content, and to teach in collaborative teams

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